



## **MEMORANDUM**

TO: Tim Bodell, Hopi Utilities Corporation

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DATE: September 11, 2018

**SUBJECT: Hydraulic Model Analysis of Hopi Arsenic Mitigation Project (HAMP)  
Regional Water System**

We recently reviewed the Indian Health Service 10% Design Report which modeled two options (Alternative A and Alternative B) for the HAMP regional water system. Upon review of these alternatives and discussions with Hopi Utility Corporation (HUC), high operating pressures along the pipelines are of concern in the I.H.S. modeled, with much of the pipeline operating over 200 psi. Consequently, we prepared a water model in InfoWater to analyze a slightly different alternative from those proposed in the I.H.S. 10% Design Report. This memorandum describes that alternative, and summarizes benefits from the proposed changes to the design concept.

The demands for Hopi Cultural Center, Upper Sipaulovi/Mishongovi and Shungopavi combined were modeled at 88.9 gallons per minute. This represents 12 hour pumping, for a peak day future demand of 64,008 gpd. The demand for First Mesa Consolidated Villages, the hospital and lower Sipaulovi combined were modeled at 351,7 gpm (253,235 gpd).

### **Proposed Alternative C**

The alternative developed and analyzed by DBS&A in cooperation with HUC will be referred to as Alternative C. The alternative is described below.

Water is pumped from Turquoise Trail Wells 2 and 3 to Hopi Tank 1, which is located at the intersection of Indian Route 43 and IR8. From Hopi Tank 1, water flows by gravity to Polacca East Tank and is pumped to a proposed tank at the Hopi Cultural Center. We modeled an alignment for the pipeline to Polacca East Tank that represents a tunnel through the mesa, significantly shortening the length of pipe needed.

From the Polacca East Tank, water flows by gravity to Polacca West Tank and then by gravity to the Lower Sipaulovi Tank.



Water from the proposed Hopi Cultural Center Tank is pumped to the Shungopavi Elevated Tank and also pumped to a proposed Sipaulovi/Mishongovi Tank. The booster pumps to these two tanks would have different design points, but both sets of pumps could be housed in a single pump house near the proposed Hopi Cultural Center Tank.

### **Variation from I.H.S. Alternatives A and B**

The proposed Alternative C includes elements from I.H.S. Alternatives A and B. Like Alternative A, it is configured as a “wishbone” with a transmission main down IR8 to First Mesa, and down IR 4 to HCC and 2nd Mesa. Similar to Alternative B, Alternative C conveys most of the water demanded via gravity, saving on pumping costs, by meeting First Mesa Demands and Lower Sipaulovi demand via gravity from Hopi Tank 1.

One significant difference in Alternative C is that Hopi Tank 1 is set at an elevation of 6,135, with overflow elevation (OFE) of 6,159, rather than OFE of 6,203 as shown in the IHS 10% Design Report. Also, water is delivered via gravity to Polacca East Tank which is at a higher elevation than Polacca West Tank and then from Polacca East to Polacca West Tank. The Polacca East Tank is 144’ higher than the Polacca West Tank. These changes reduce the differential in water levels between Hopi Tank 1 and the Polacca East Tank, such that pressure along the pipeline is reduced significantly.

The model currently includes a ground storage tank at the wells, with a booster station pumping to Hopi Tank 1. Alternatively, the wells could be equipped with well pumps which pump directly to Hopi Tank 1. However, our preliminary investigations into submersible pumps in this range indicate that pump availability and selection would be better without the 300 feet of additional lift required to pump to the tank. The pumping water level alone in those wells exceeds 760 feet, and the overall calculated total dynamic head to the tank is around 1,100. This will be further evaluated, including a lifecycle cost analysis and consideration for pump times and availability.

### **Benefits**

Some of the benefits of the proposed configuration are as follows:

- Reduced operating pressures throughout the proposed system. Maximum pressures for Alternative A are 239 psi, and for Alternative B are 287 psi. Maximum pressures under Alternative C are approximately 179 psi near the elevated tank and between Hopi Tank 1 and Polacca East Tank.
- Less additional water storage added representing lower capital and recurring O&M costs for tanks. Recommended tank sizes will be refined with further analysis.
- Opportunity to phase the regional water system implementation with Phase 1 being the east side of the “wishbone” which serves the majority of the water demand and Phase 2



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*Daniel B. Stephens & Associates, Inc.*

being the west side of the “wishbone”, providing service to potential customers along IR4 and Upper Sipaulovi.

### **Next Steps**

This memorandum is provided as an update on our analysis. We plan to proceed with model development to include storage evaluation under Extended Period Simulation, and cost comparison of Alternative C with Alternatives A and B.

We welcome any feedback on this information.